Assignment 2
Reverse Mouse Trap

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Part 0

Easy Mousetrap

The "easy" mousetrap is a simple series of levers. After the ball falls on the first lever, each lever turns the next until the third and final one pulls a string which lifts the door up inside the reverse mousetrap, so it may escape.

Five subjects were asked to figure out the order of operations and solution to this reverse mousetrap. Each is an undergraduate student, studying Molecular Biology (A), Economics (B), Flute Performance (C), Biology (D), and Biomedical Engineering (E). All five subjects were easily able to deduce that the ball would drop causing the first lever to pivot upwards, causing the next to pivot downwards, causing the last to pivot upwards, and finally pulling the door attached to the string upwards. Subject C did, briefly, express uncertainty with respect to the directions of the levers, deciding that the system wouldn't move at all at first. However, after a second review of the reverse mousetrap recognized the confusion and then correctly solved the problem.

As expected, the easy problem was fairly simple for people to solve. Each subject appeared to both physically and mentally imagine the levers moving, one-by-one pointing in the direction each lever would move. As such, this problem seems easily resolved for all subjects using imagery-based logic.

Medium Mousetrap

In creating the medium difficulty level reverse mousetrap, an interesting observation was made about the designs in general. The original plan for this reverse mousetrap was to have many pulleys with one string going around them all crisscrossing in all directions. In order for this design to be drawn the green line representing the string must intersect itself many times. If this had been done, a computer trying to solve it already has no assumption knowledge of a "forward" and "background" string. Instead, a computer would assume the overlapping string sections are actually constructed so that the string is fused together in that way. Since the problem space we are studying is a 2-dimensional area, the designs must be 2-dimensional. We cannot create a design where items overlap, because then one must assume which item is in the background and which is in front. As humans this usually happens naturally, completing the image in our minds, but a computer "sees" overlapping items as simply being fused together in the same plane. Instead, this medium design includes several pulleys, but none of which allow for the string to overlap itself.

Three other people were shown this design. All of them are college educated, but only one of which is currently enrolled in a degree program. They all seemed to enjoy solving the problem, noting its similarity to nostalgic things for them, such as the game Mousetrap or the movie Chitty-Chitty-Bang-Bang. They were simply asked what happens in the picture when the ball falls, and noted the position in the picture of the ball. Immediately, two of them had at least one question about the design elements itself. These questions included confirming the black circles and green lines were pulleys and string and asking what the blue object was. Since they did not see the rules that explain a yellow circle in a blue object means that object can pivot around it, they did not assume that was how it was allowed to move. Once I confirmed the string around the pulleys and the lever can pivot around the yellow circle, they were all immediately able to explain the solution step by step.

None of the participants had any difficulty explaining back that the ball will fall, lowering one side of the lever and the other side will be raised pulling the string around all of the pulleys, and finally pulling the attached door at the end of the string upwards. While solving the problem none of the people used any hand motions or movement, just eye movement across the image. However, when explaining out loud their conclusions and play by play analysis of the steps, each person did use their hands to point to the separate parts, mimic the motion of the ball falling and lever turning, and then tracing across the connected string piece. Since they did not seem to need the use of their hands to solve the design, one might assume it is simple enough to visualize the solution purely in their minds. Since hand gestures were used in their explanations, one might assume it does aid them in confirming their predictions and find it easier than translating all the explanations back into words.

Advanced Mousetrap

Another three people were shown the advanced level reverse mousetrap. Two are currently studying Social Sci-

ence, Library Information Theory(A) and Experimental Psychology(B) respectively, and one is a student in Continuous Mathematics(C). All questions were initiated by the same statement, "What do you see?."

Subject A's initial answers were interesting. She did not think that she would be able to solve the problem in under 3 seconds of thinking. However, after some explanations of what the task at hand was, she immediately understood the problem and started asking questions. The questions were, whether the weights of the objects were different, if the ball was elastic, and whether there is a friction applied to objects. After giving specific assumptions about the problem, then she was very happy with solving, and explaining a sequence of mechanical interactions which she elaborated sequentially starting from the drop of the ball.

When subject B encountered the advanced problem, he raised two questions. The first question was that he was not sure whether a certain component, a bar that is lifted by three gears on the left side and interacts with bars on the right side, would work properly or not. The second question was whether a ball that will turn a big gear would work or not since the ball seemed too small and light. When asked, subject C requested information regarding the weight of the ball compared to the door and friction as well.

Our observations for the advanced design revealed that as more time was put into solving the design, people tended to crave for more information of the environment and its components. Once that information was given, their depth and accuracy of reasoning increased. Also, their region of interest moved on from the whole picture to smaller details, and from a sequential viewpoint to a simultaneous viewpoint.